Testing a Deactivated Virtual Environment in Pathological Gamblers' Anxiety

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Abstract. In the last decades the use of Virtual Reality for exposure therapy has become a clinical standard and used in most disorders, including pathological gambling. Nonetheless, previous studies reported that exposure therapy might be not effective if the virtual environments present no interactions or break in presence, among other problems. We hypothesized that a virtual environment representing a gambling place but without lights and sounds or other stimuli promoting interactions, was not effective for gamblers. Thus we tested the anxiety level in a group of 20 pathological gamblers in this lights out virtual environment. Our results shown, by using Bayes Factor, that before and after an exposure to the lights out virtual gambling environments there was no difference in anxiety level. The study shed new light in designing and implementing virtual reality exposure therapy for future clinical applications.

Keywords: Gambling · Virtual reality · Anxiety · Exposure · Psychometrics · Gambling disorders · Addictions

1 Introduction

Pathological Gambling (PG) is a common psychiatric disorder that is associated with severe problem gambling. Who suffer of this has an urgent need to gamble interminably despite the numerous negative harmful consequences and desire to stop.

Another common feature shared by people who suffer from gambling addiction is impulsivity that can be defined as precipitately, non-inhibited, inappropriate, extremely risky behavior with potentially serious consequences (Durana et al. 1993).

Many evidences suggest that alterations in fronto-striatal circuits contribute to the tendency to behave impulsively (Fineberg et al. 2014).

Furthermore, is possible to distinguish two different components: the impulsive action and the impulsive choice (Evenden 1999).

The first can be defined as the diminished ability to inhibit motor responses, while the second one refers to tendency to selecting smaller immediate rewards instead of larger and long-term rewards.

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Indeed, the pathological player, as well as the patients who abuse substances, are characterized by dysfunctional behavior in decision-making processes and by the high dependence on reward that leads to the adoption of risky and loss strategies.

From recent studies has emerged an association between pathological gambling and deficits in frontal lobe function; in addition, the pathological gambler subjects show similar behavior to patients with bilateral VMPFC lesions (Bechara et al. 1994; Balodis et al. 2012) and SUD patients (Balconi et al. 2014).

Initially, Pathological Gambling was classified as "Impulse Control Disorder" (ICD), but in DSM-V was re-classified as an addictive disorder (DSM-V; American Psychiatric Association 2013).

Although there is still an open discussion about the classification of this disorder, some authors consider it more appropriate to think of pathological gambling as addiction (Fauth-Bühler et al. 2017). Many evidences seem to demonstrate as some core elements of addiction, such as tolerance and withdrawal, are relevant to PG and Drug dependence (DD).

At the neuronal level, Potenza et al. (2003) in their fMRI study, observed in pathological players compared to recreational ones, a change in the signal dependent on the level of oxygen in the blood (BOLD) in the frontal cortical regions, basal ganglion and the thalamic brain, only when people viewed gambling tapes and not during an happy or sad videotape.

Particularly, when were presented the most intense gambling stimuli, people who suffer from Pathological gambling compared who do not suffer it showed a relatively diminished of the BOLD signal in ventromedial prefrontal cortex (vmPFC). Furthermore, another fMRI study had demonstrated a less activation of vmPFC and in the ventral striatum during simulated gambling in individuals with PG as compared to those without (Reuter et al. 2005).

At the level of neurotransmitter systems, Roy et al. (1988) found higher levels of noradrenaline (particular relevant to aspects of arousal and excitement) in urine, blood or cerebrospinal fluid samples in the Pathological Gamblers as compared to those without PG; moreover studying serotonine, neurotransmitter particularly relevant to behavioral initiation and cessation and in mediating impulse control, Nordin and Eklundh (1999) observed in people with PG low levels of the serotonin metabolite 5-hydroxy indoleacetic acid.

During the last decades Virtual Reality became a new tool inside the field of therapy (Cipresso et al. 2018; Cipresso and Immekus 2017). There are several evidence, in research and clinical practice, that show how virtual reality can help, especially in exposure therapy (Repetto et al. 2013; Villani et al. 2012; Serino et al. 2014; Gaggioli et al. 2014; Cipresso et al. 2012, 2015, 2016, 2019). However, Pallavicini and Collegue hypothesized and verified that sometimes virtual reality is not always an effective stressor for exposure treatments (Pallavicini et al. 2013).

Due to this, it was hypothesized that a lights out virtual environment was not able to increase the level of anxiety in pathological gamblers, due to the missing interactions that represents the real activating elements to generate anxiety in these patients (Figs. 1 and 2).

Fig. 1. Virtual environment representing a gambling place.

Fig. 2. Same virtual environment of Fig. 1, representing a gambling place, but without lights and sounds or other stimuli promoting interactions.

2 Procedure

Participants

The study will involve 20 adults without vestibular or balance disorders, and with a diagnosis of gambling disorder.

Procedure

Participants were patients recovered and patients who have been dismissed, both from Clinica Villa Silvia in Italy, with a diagnosis of Gambling. The psychiatrist of the Clinic invited them to take part of the study.

Patients were invited to Villa Silvia and they were kindly invited to take a seat, while explaining them what the study was about, showing them the tools of the study. In particular the participants were instructed in using the HTC VIVE virtual reality system and to navigate in a virtual environment. Also Near Infrared Spectroscopy (NIRS) was recorded, in order to detect frontal and pre-frontal activation during the virtual reality navigation.

After having explained them all the procedures, and having answered to all their doubts and questions, they were asked to sign the informed consent and to reply to the STAI-Y1 and STAI-Y2 questionnaires.

In the experiment, we first recorded the baseline having asked the participant to close his/her eyes and try to relax for 5 min. After the baseline, we put the HTC VIVE (with the NIRS on, there was no interferences using the helmet), and we asked the participant to navigate inside the environment without any specific task for 5 min.

Successively we asked to complete the last questionnaire STAI-Y2 in order to detect if the level of anxiety would have increased or not.

3 Data Analysis

In order to test our hypothesis, that the present virtual environment is not an activating environment and therefore would not elicitate anxiety in former gamblers, we used Bayesian statistics provided by JASP Team: "JASP" (2018). In this sense, we used paired T-Test Bayes Factor (BF) to compare baseline state (Y1) STAI *vs.* post-exposure state STAI. R (Balodis et al. 2012) and ggplot2 package (Bechara et al. 1994) were used for descriptive purposes of our sample (e.g. plots and descriptives). We excluded one participant, who did not accomplish the experimental session, whereas one participant did not filled out properly the state STAI after the exposure.

4 Results

Results are reported in relation to the hypothesis:

Null Hypothesis (H_0): there is no difference, in our sample, between the baseline and post-exposure of the STAI scores.

Alternative Hypothesis (H_1): baseline and post-exposure of the STAI scores are different in the sample.

First, we reported descriptive statistics (Table 1) of our sample.

Table 1. Descriptive statistics. Age, YoE (years of educations), STAI of state (Y1) for baseline and post-exposure and STAI of trait (Y2) are reported.

	N	Mean	SD	Median	Max	Min	Skewness	Kurtosis
Age	19	43.05	12.71	43	70	26	0.39	−1.01
YoE	4	13.25	4.11	13.5	18	8	−0.13	−1.89
Y2	19	49.16	9.66	52	65	29	−0.50	−0.81
Y1 baseline	19	35.95	11.67	32	61	20	0.55	−0.91
Y1 post	18	33.72	11.08	30	58	20	0.81	−0.62

The figure below (see Fig. 3) shows the scores of STAI in the clinical sample using boxplots.

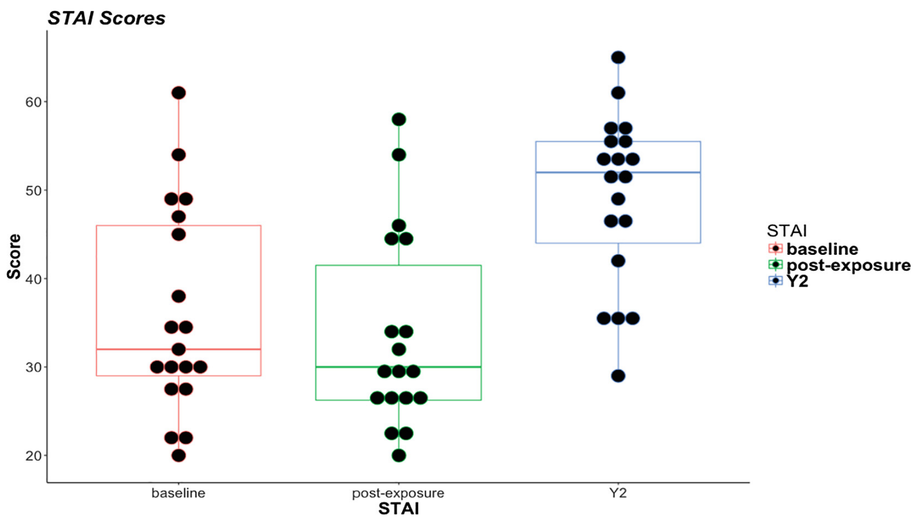

Fig. 3. Boxplots of Y1 baseline and Y1 post-exposure and Y2 are reported with each data point.

Results showed moderate evidence, as emerged from T-Test Bayes Factor, (BF_{01} = 2.363; err. = 0.005) that STAI scores are equal after the exposure to salient environment (see Figs. 4 and 5).

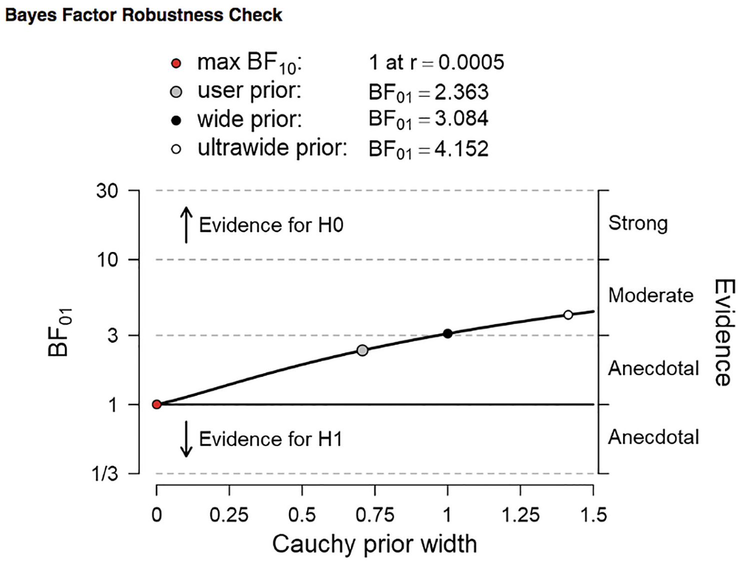

Fig. 4. The figure shows the robustness of the evidence for H_0.

Prior and posterior distributions are displayed in the Fig. 6. To summarize, Y1 (baseline) and Y2 (post-exposure) scores were statistically significantly similar before and after the immersion in the environment. Therefore, H0 was not rejected.

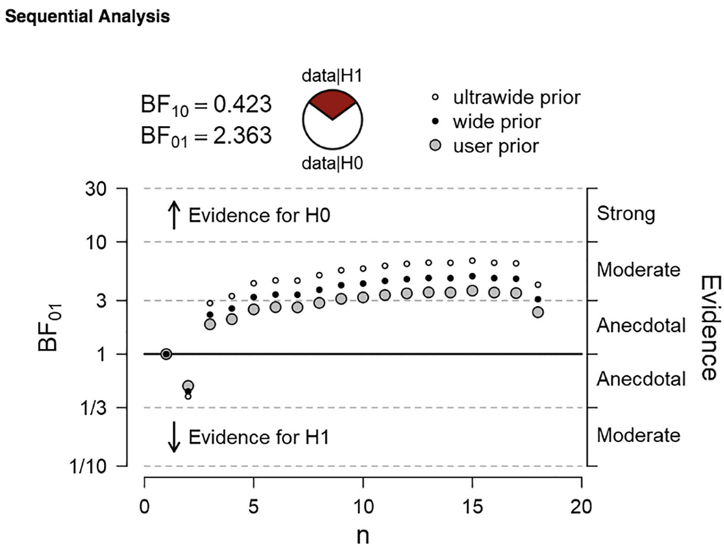

Fig. 5. Sequential analysis of each observation shows again a moderate evidence for H_0.

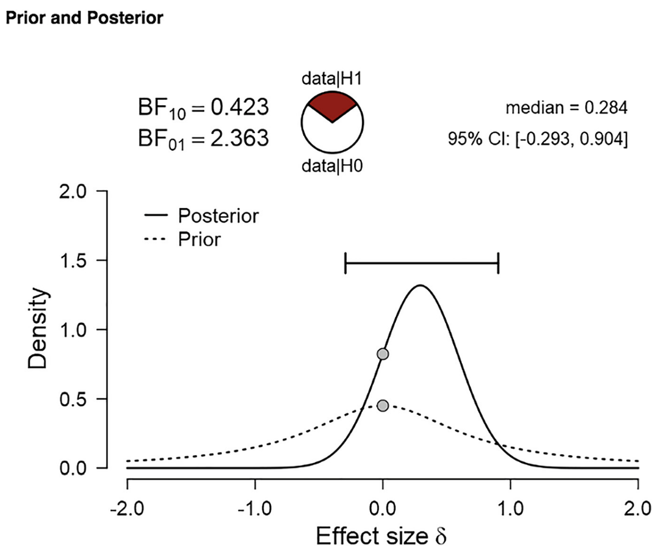

Fig. 6. Bayesian graph of Y1 (baseline) *vs.* Y2 (post-exposure) scores.

5 Conclusion

Anxiety generated by relevant scenes in virtual environment is considered a consolidated element in virtual reality exposure therapy. Nonetheless, the extend to which an environment can be really activating is less investigating.

In this study we wanted to demonstrate that to be activating an environment needed to be more than related to the patients. We used an environment that simulated the typical gambling situation but with all the interacting elements deactivated. Our results demonstrated that the anxiety measured before and after this environment was quite similar, demonstrating in this way that the use of a lights out environment does not produce a relative anxiety in the participants.

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